

On the distribution of *Colias caucasica balcanica* REBEL, 1901, with two new records for Serbia (Lepidoptera: Pieridae)

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Abstract: *Colias caucasica balcanica* REBEL, 1901 is a rare and localised butterfly with a fragmented distribution in the Balkan Peninsula. Several new localities for this subspecies have been found in the last decades, while the butterfly has most likely disappeared from some of its traditional strongholds. For a long time only a single locality for Serbia was known on Mt. Kopaonik. Recently two new localities in Serbia were found, in two mountains never entomologically explored before, which makes this discovery very important for the status of the butterfly in this country. The history of this taxon is given, all the records in Balkan Peninsula were summarized and a distribution map is provided.

Key words: butterfly distribution.

Zur Verbreitung von *Colias caucasica balcanica* (REBEL, 1901) mit zwei neuen Funddaten aus Serbien (Lepidoptera: Pieridae)

Zusammenfassung: *Colias caucasica balcanica* REBEL, 1901 ist ein seltener und sehr lokal vorkommender Tagfalter mit fragmentiertem Verbreitungsmuster auf der Balkanhalbinsel. In den letzten Jahrzehnten wurden etliche neue Vorkommen dieser Unterart dokumentiert; andererseits ist sie offenbar von einigen früheren Hauptverbreitungsarealen verschwunden. Aus Serbien war die Art lange Zeit nur von einer Stelle bekannt, dem Berg Kopaonik. Kürzlich konnten in zwei vorher entomologisch unerforschten Gebirgsstöcken zwei neue Vorkommen nachgewiesen werden, die für den Status der Art in Serbien wichtige Basisdaten liefern. Die Geschichte der Unterart, alle Nachweise auf der Balkanhalbinsel und eine Verbreitungskarte werden dargestellt.

Introduction

Colias caucasica STAUDINGER, 1871 inhabits two widely disjunct areas. One covers the high mountains of the Balkan Peninsula where subspecies *balcanica* REBEL, 1901 was described, while the nominotypical ssp. *caucasica* STAUDINGER, 1871 occupies parts of eastern Turkey and the Caucasus region (parts of Russia, Georgia, Armenia and Azerbaijan).

The species was first discovered by J. HABERHAUER, who collected a few specimens close to Lake Sevan (Sevana Lich) in Armenia in 1868. J. LEDERER (1870) came across these specimens and considered them to be a form of the species *Colias myrmidone* (ESPER, 1781). After LEDERER's death, later that year, the specimens were acquired by O. STAUDINGER, who described them in 1871 as "*myrmidone* v.? *Caucasica*" (compare WAGENER 1990).

The description of the subspecies *C. caucasica balcanica* follows a similar pattern. H. REBEL found the species in the mountains of Bosnia and Herzegovina and described it as "*Myrmidone* Esp. var. *Balcanica*" (REBEL 1901: 250, Nr. 114c). K. SCHAWERDA (1906) acquired further

specimens from Bosnia and Herzegovina and noticed some differences between the Balkan populations and the specimens found in the vicinity of Vienna. He stated that the Balkan "variety" of *C. myrmidone* is larger and has a more intense orange hue than those specimens found near Vienna. He also compared them with specimens from the Caucasus, but despite detecting these differences, he followed REBEL's opinion that these all belonged to the species *C. myrmidone*. His conclusion was that variations in shape, size and colour were the result of the distance between populations and differences in climate. He also concluded that the differences between the populations from the environs of Vienna, the Balkan and the Caucasus were simply subtle variations of the same species and as a gesture of respect named the white form of the ♀ as "*f. rebeli*" (SCHAWERDA 1906). REBEL's opinion that Balkan specimens were simply variations of *Colias myrmidone* was accepted by ROEBER (1907), LEDERER (1941) and THURNER (1964). SCHAWERDA (1939), however, in his last publication on *Colias caucasica balcanica*, considered them to be a separate species.

HIGGINS & RILEY (1970) as well as SCHEIDER & JAKŠIĆ (1989) also considered the Balkan populations to be a separate species. E. REISSINGER (*in* WAGENER 1990) was the first to treat the species as a subspecies of *Colias caucasica*. Such opinion was later accepted by the majority of entomologists (HESSELBARTH et al. 1995, TOLMAN & LEWINGTON 2008, VERHULST 2000, GORBUNOV 2001, GRIESHUBER & LAMAS 2007). The nominotypical form is very similar to ssp. *balcanica*, but WAGENER (1990) noted some small differences: the average wingspan of ssp. *caucasica* is 55 mm, 50 mm for ssp. *balcanica*, and the orange hue of the upperside of the forewings is somewhat different. He even raised doubts about the classification of ssp. *balcanica* as a separate subspecies. The only reason he saw for maintaining the distinction was due to the vast distance of more than 2000 km separating these populations.

The habitat of the subspecies *Colias caucasica caucasica* in the Caucasus are mountains ranging from 1000 to 1700 m, with sparse pine wood, and a flight time from VI. to VII. in 1 generation (NEKRUTENKO 1990). Some further records for the Caucasus state that the species can be found as low as 800–1200 m, with a flight time from mid-V. to mid-VI., with occasionally specimens found in VII. (ROMANOFF 1882). In northeast Anatolia (Turkey), the species has a much wider altitudinal span, ranging from 1800–2500 m with a flight time from mid-VII. to the beginning of VIII. (HESSELBARTH et al. 1995). In Mt. Kaçkar it is most commonly found at 2000–2100 m

(DAVKOV pers. comm.). An exception to this is a colony found at just 600 m in Saribudak (Artvin province) flying at the end of VI. (HESSELBARTH et al. 1995). The larval host plant has still not been precisely determined, although some authors suggest it could be one of the species of the genus *Cytisus* (L.) (NEKRUTENKO 1990) or *Astragalus caucasicus* (PALL.) (VERHULST 2000). The subspecies *caucasica* ranges from the western Caucasus through Armenia (in the vicinity of Sevan Lake), Georgia (Borzhom [= Borjomi], Akhaltsikhe, Abastumani, Atskhour and the Meskhetin mountains), the Russian Republic of Dagestan (Akhty), all the way to Azerbaijan (near Helenendorf [Goygol is the modern name for Helenendorf, founded in 1819 by German settlers], Elisabethpol [nowadays called Ganya; this name refers to Elisabethpol governorate of the Russian Empire, formed in 1868; in Cyrillic letters: Елизаветпольская губерния. The capital was Elisabethpol, again Ganya since 1991] and near Ordubad on Mt. Zangezur on the Armenian border) (VERHULST 2000). In Turkey, the species was recorded on Kaçkar, Diglab, Barhal and Yalzinçam Geçidi Mountains, as well as in the area of Saribudak (HESSELBARTH et al. 1995). Although GORBUNOV (2001) listed Iran as one of the countries where the species can be found, it most likely is not present there (NAZARI 2003).

Since the eastern part of the range is in many places inaccessible and entomologically understudied, it is likely that the distribution of the nominotypical subspecies is wider, but further studies would be needed in order to give a more accurate picture of its true range.

Distribution in the Balkan Peninsula

Colias caucasica balcanica is distributed across the Balkan Peninsula from Bosnia and Herzegovina to the north of Greece. It inhabits high mountains, usually between 1200 and 2200 m. ♂♂ fly swiftly over meadows where the larval host plant is present and even though they are able flyers, it seems they do not venture far outside their habitat. ♀♀ are less active, despite also being capable flyers. The larvae feed on *Chamaecytisus hirsutus* (L.) (OTTMÜLLER 1991, TOLMAN & LEWINGTON 1997, 2008), while ABADJIEV (1994) lists *C. absinthioides* (JANKA) for Bulgaria.

The subspecies *balcanica* was recorded at the following localities (see Fig. 1, map):

Bosnia and Herzegovina:

- Trebević (DE LA B. NICHOLL 1899, REBEL 1904, SIJARIĆ 1991),
- Romanija (REBEL 1904),
- Sjemeč (REBEL 1904),
- Kalinovik (REBEL 1904),
- Šator (SIJARIĆ 1977),
- Vučija bara–Gačko (DE LA B. NICHOLL 1899, REBEL 1904, SCHAWERDA 1906),
- Kupreš: Gornji Malovan i Jaram (SIJARIĆ 1991, HESSELBARTH et al. 1995),

- Stožer (GOOSSENS-CROMPHOUT & GOOSSENS-CROMPHOUT 1982),
- Vodice near Lipnik (SCHAWERDA 1922).

Montenegro:

- Tara Canyon (DE LA B. NICHOLL 1902).

Serbia:

- Kopaonik (BURESH & TULESCHKOW 1928–29, JAKŠIĆ 1988).

Republic of Macedonia:

- Baba (HANISCH 1993, DAVKOV pers. comm., MELOVSKI pers. comm.),
- Šar-planina (MELOVSKI 2002, DAVKOV pers. comm.),
- Osogovo Mts. (THURNER 1964, DAVKOV pers. comm.),
- Kožuf (DAVKOV pers. comm., MELOVSKI pers. comm.),
- Jakupica (DAVKOV pers. comm.),
- Karadžica (DAVKOV pers. comm.),
- Dautica (THURNER 1964),
- Stogovo (DAVKOV pers. comm.),
- Karaorman (THURNER 1964),
- Korab (THURNER 1964, DAVKOV pers. comm.),
- Bistra (HESSELBARTH et al. 1995, DAVKOV pers. comm., MELOVSKI pers. comm.),
- Nidže (MELOVSKI pers. comm.),
- Galičica (VEROVNIK et al. 2010, DAVKOV pers. comm.),
- Maleševo Mts. (VEROVNIK 1989).

Bulgaria:

- Osogovo (ABADJIEV 1992, 2001, ABADJIEV & BESHKOV 2007),
- Rila (DE LA B. NICHOLL 1900, REBEL 1903, BURESH & TULESCHKOW 1928–29, ABADJIEV 1992, 2001, ABADJIEV & BESHKOV 2007),
- Rhodopi (BURESH & TULESCHKOW 1928–29, ABADJIEV 1992, 2001, ABADJIEV & BESHKOV 2007),
- Vitosha (BURESH & TULESCHKOW 1928–29, ABADJIEV 1992, 2001, ABADJIEV & BESHKOV 2007).

Greece:

- Varnous (PAMPERIS 2009, LAFRANCHIS pers. comm.),
- Voras = Kaimaktchalan (PAMPERIS 2009, COUTSIS pers. comm.),
- Vitsi = Vernon (PAMPERIS 2009, VERHULST 2000, COUTSIS pers. comm.),
- Tzena (COUTSIS pers. comm.),
- Grammos (PAMPERIS 2009),
- Nemertska (PAMPERIS 2009).

Bosnia and Herzegovina represent the northwestern limit of the species, and that is where this butterfly was first caught, at the beginning of the 20th century. The majority of the records is more than a hundred years old and came from REBEL himself, who gathered a considerable amount of data from various authors. REBEL collected this species in Trebević near Sarajevo, Kalinovik and Vučija Bara, while V. APFELBECK found it on

Mt. Romanija and Mt. Sjemeč (REBEL 1904). However, one of the first explorers of the area and one of the first entomologists to collect this species was Miss M. DE LA B. NICHOLL, who found *Colias caucasica balcanica* on Mt. Trebević and on Mt. Baba (Vučija Bara) considering it to be *Colias myrmidone*. Additionally the species was collected by Vinzenz HAWELKA at Vodice near Lipnik at the border to Montenegro (SCHAWEDRA 1922). For many years after the work of the mentioned entomologists there was a huge gap in butterfly study in Bosnia and Herzegovina. It was not until R. SIJARIĆ started systematic exploration of the mountains of Bosnia and Herzegovina in the late 1960s that new observations were made. While exploring Mt. Sjemeč he stated that the butterfly was not found on that locality (SIJARIĆ & MIHLJEVIĆ 1980/81) and also that there were no new records for this species from Mt. Trebević (SIJARIĆ 1977). Among the last were the specimens from the B. MIHLJEVIĆ collection dated from 1975, 1976 and 1977 (SIJARIĆ 1991). Some newer records of the species for Bosnia and Herzegovina originate from the mountains surrounding Kupreško polje (Mt. Malovan, near Gornji Malovan and Mt. Jaram) and are in the B. MIHLJEVIĆ collection (SIJARIĆ 1991). This species was also found on Mt. Šator near Grahovo (SIJARIĆ 1977) and on Mt. Stožer close to Kupres (GOOSSENS-CROMPHOUT & GOOSSENS-CROMPHOUT 1982).

The situation concerning Montenegro is quite uncertain. Available data are scarce and very old, dating from the beginning of the 20th century when M. DE LA B. NICHOLL explored the area of Mt. Durmitor and the Tara Gorge. She managed to see several specimens of *Colias caucasica balcanica* in the higher plateaus of the Tara Gorge (DE LA B. NICHOLL 1902), considering them to belong to *C. myrmidone*. However, she was not able to collect any. She did not give any specific location, just described the road she took while approaching the Tara Gorge. However, we could suppose it was in northeastern part of what is nowadays Durmitor National Park. She explored the massif of Mt. Durmitor for several days, but she never either collected or saw any specimen in that area (DE LA B. NICHOLL 1902). The area was thoroughly surveyed in the 1980's and the species was not found but was listed for "the general area" on the basis of the mentioned record for Tara Gorge (SIJARIĆ et al. 1984). The authors of this paper also visited the Mt. Durmitor massif on several occasions with no success in finding the species.

In Serbia, the only known locality to date has been Kopaonik National Park where the butterfly inhabits typical high-mountain habitats with steep meadows above the tree line at 1600–1800 m, overgrown with the larval host plant. Such meadows on this mountain are under a significant amount of anthropogenic pressure, due to holiday resort expansion and new ski slopes, as well as the substantial number of tourist visits during the summer months. Despite this, during our visits in VIII. 2009 and VII. 2010, dozens of specimens were spotted and the colony appeared to be stable.

In Macedonia there is a substantial number of recorded localities distributed throughout the country. The most numerous colonies were spotted on Mt. Baba (HANISCH 1993, DAVKOV pers. comm.). This mountain, together with Šar-planina, Mt. Korab, Mt. Stogovo, Mt. Karorman, Mt. Galičica, Mt. Nidže and Mt. Kožuf forms a chain of localities, almost interconnected, passing near the borders with Albania and Greece. The only more separate colonies are the ones from the massif of the three mountains Mt. Karadžica, Mt. Jakupica and Mt. Dautica in the central part of the country, together with the Osogovo and Maleševo Mts. which are possibly connected with Bulgarian populations, although they are not known from the Bulgarian side of the Maleševo Mts. (BESHKOV pers. comm.). It must be noted that *C. caucasica* was not re-found on Osogovo Mts. during recent survey of the mountains (MICEVSKI & MICEVSKI 2008). Until a few years ago, no records existed for the Šar-planina massif, although JAKŠIĆ (1998) considered the possibility of the species' presence there, due to the suitable habitats and the fact that it inhabits surrounding mountains. MELOVSKI (pers. comm.) has found several specimens at Gorno Jelovce and Dedel Beg located on southern slopes of Šar-planina. The latest record for Macedonia comes from Mt. Galičica where VEROVNIK et al. (2010) found two specimens near a road pass, at an altitude of 1565 m. At the beginning of VIII. 2010, in the same mountain some more specimens were collected by S. DAVKOV at an altitude of 1950–2000 m (DAVKOV pers. comm.).

The butterfly has been recorded on several mountains in Bulgaria, but most of these records are for Rila Mts., where the only numerous and stable colonies are known. Records from the Osogovo Mountains are linked to the same mountain massif in Macedonia and it can be deduced that it is a single large colony. Records from Mt. Vitosha near Sofia are very old, the most recent having been recorded 45 years ago (BURESCH & POPOV 1965), while later attempts to find the butterfly on the same mountain remained unsuccessful (KOLEV pers. comm., ABADJIEV & BESHKOV 2007). A similar situation applies to the Rhodopi Mts., but its vast expanse accompanied by insufficient surveys makes a final conclusion impossible.

Records for Greece are limited to the northern parts of the country, primarily Mt. Varnous, which is actually an extension of Mt. Baba, and two other mountains on the border with Macedonia. The most recent data from PAMPERIS (2009) mention the Grammos and Nemertska Mountains as new localities for the butterfly. Both of these mountains border with Albania, with the latter stretching further into Albanian territory, so it is reasonable to conclude that *C. caucasica balcanica* inhabits these mountains in Albania as well. Records mentioned by JAKŠIĆ (1998) and VAN SWAAY et al. (2007) for Mt. Chelmos or Mt. Aroania on the Peloponnese probably rely on the observations of HAIG-THOMAS (1931) who mentioned one female *C. caucasica balcanica* caught there. Most probably the record is related to a ♀ of *Coli-*

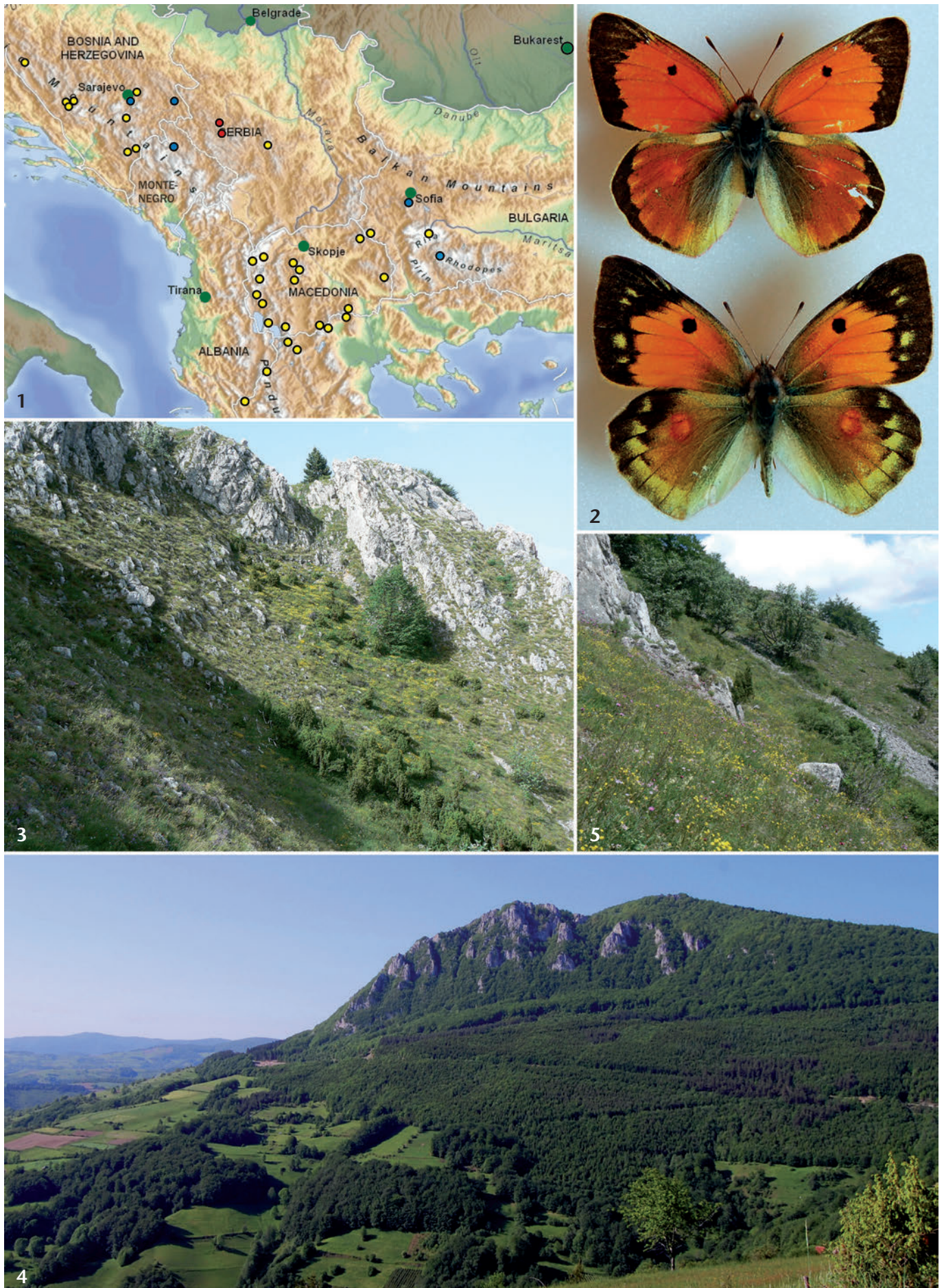


Fig. 1: The currently known distribution of *Colias caucasica balcanica* in the Balkan Peninsula. The two new records are marked in red, supposedly extinct colonies in blue, other colonies yellow. **Fig. 2:** ♂ and ♀ of *Colias caucasica balcanica* from Mt. Mučanj. **Fig. 3:** Habitat of *Colias caucasica balcanica* on Mt. Mučanj. **Fig. 4:** View of Mt. Mučanj. **Fig. 5:** Habitat of *Colias caucasica balcanica* on Mt. Javor.

as *aurorina* (HERRICH-SCHÄFFER, 1850), as *C. caucasica balcanica* has never been reported on this well-studied mountain again (FOUNTAIN 1902, JOHNSON 1965, THURNER 1967, BRETHERTON 1968, SCHMIDT-KOEHL 1980, FUCHS 1985, 1987 and LEESTMANS & ARHEILGER 1987), or in the Peloponnese (PAMPERIS 2009).

There are no relevant data for Albania and more research is required in this country, but a reasonable assumption can be made that this butterfly could be found there as well, since its occurrence on the Macedonian side of Mt. Kožuf and Mt. Galičica and the Greek sides of Grammos and Nemertska Mts. The species has never been recorded in Croatia (KUČINIĆ pers. comm.) and Romania (SZÉKELY 2008).

New records

In 2007, the authors of this paper began systematic research in the Mučanj area, a mountain which at that time had been absolutely unknown in entomological terms. In VII. 2008, they discovered a new colony of *Colias caucasica balcanica*, proving that the presence of the species in Serbia is not limited to Mt. Kopaonik.

Mt. Mučanj is situated in Western Serbia close to the town of Ivanjica and spreads from 43°32'44.79" to 43°33'0.06" N and from 20°2'54.37" to 19°57'38.60" E. The mountain reaches an altitude of 1534 m on the peak named Veliki Mučanj, with another two important summits, Srednji Mučanj (1424 m) and Mali Mučanj (1395 m). The neighbouring mountains are Golija and Javor, separated from Mučanj by rivers Grabovica, Veliki Rzav and Presječka Reka.

At the beginning of VII. 2008, the authors investigated a wider area of Veliki Mučanj and at the altitude of approximately 1400 m collected a ♀ first and a ♂ afterwards at the Savina Voda locality. Before collecting the specimens, several butterflies were seen flying around a locality where plants of the genus *Chamaecytisus* (LINK) were abundant. Inclement weather during the following days made any further investigation and specimen collection impossible. During field research in VI. 2009, several specimens were spotted, but strong winds and bad weather prevented further collecting. At the end of VI. and during the first half of VII. 2010, the authors found more specimens and managed to collect a further 5 ♂♂ and 2 ♀♀ at the same locality. This is evidence that the butterfly forms permanent colonies at this site and that it does not stray far from its habitat. All spotted butterflies were observed flying over steep southern and south-eastern slopes of Veliki Mučanj, within an area of less than 2 hectares.

In addition to this interesting finding, it was also established that the only species of the genus *Chamaecytisus* present on this mountain is *Chamaecytisus ciliatus* (WAHL) (STANIĆ 1990 [unpubl.], STANIĆ & LAKUŠIĆ 1993, VUKOJIČIĆ & LAKUŠIĆ 1995) which provides grounds for the assumption that this is the larval host plant on

this particular mountain. Until this point, the only known host plants were *C. hirsutus* and *C. absinthoides* (ABADJIEV 1994). On Mt. Mučanj *C. ciliatus* is a plant frequently found on calcareous rocky terrains, less often in crevices and on rocks (STANIĆ 1990). This plant is present in alliances of *Achnatherum calamagrostis* at an altitude of 1250 m on southern and south-eastern slopes, alliances of *Seslerio tenuifoliae-ostryetum* at an altitude of 1350 m also on southern and south-eastern slopes, and alliance *Potentillo-festucetum vallesiaceae* at altitudes of 1400–1450 m on southern and south-western exposed slopes (STANIĆ & LAKUŠIĆ 1993, VUKOJIČIĆ & LAKUŠIĆ 1995).

During VI. 2010, together with Duncan TREW (UK), the authors made a field trip to the nearby Mt. Javor in order to study its butterfly fauna. Javor is situated to the south of Mučanj, bordered by rivers Tisovica, Uvac, Brnjica and Nošnica. It spreads from 20°3'41.06" to 20°1'2.31" E and from 43°26'52.06" to 43°25'43.85" N. The highest summit is Vasilin Vrh which reaches an altitude of 1519 m. To the south, this mountain is linked to Pešter Plateau. During this expedition, a habitat very much like the one at Mt. Mučanj was found. The terrain was extremely steep and almost inaccessible and the presence of scree slopes was evident; even the vegetation at first glance was very similar to that encountered on Mučanj. On this mountain between the localities Vasilin Vrh and Gobeljića Krš, several ♂♂ of *Colias caucasica balcanica* were found on that occasion. However, systematic research of the area is required to make a reliable estimation of the population size and stability.

Conclusions

The two new findings are very important as far as the national insect fauna is concerned, since the species was declared threatened in Serbia (JAKŠIĆ 2003). This discovery is also important for Europe, since just a few new colonies of this species have been found in a long period of time, while several of the already known colonies from Vitosha, Tara Gorge and Sjemeč most likely disappeared during the twentieth century. Records from Trebević and Rhodopi, both of which were quite numerous in the past, have not been confirmed in recent time also, making this particular butterfly increasingly rare and threatened. This is not mirrored in the European Red List of Butterflies (VAN SWAAY et al. 2010) due to the presumed stability of its habitats in the mountainous regions where it occurs. In our opinion both abandonment of light grazing as well as intensive grazing could be dangerous for the existing colonies, as most of the larval host plants grow below the natural tree line. Further studies of larval biology and monitoring of the known populations would be of great importance to ascertain the conservation status of this fascinating and rare species.

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